

Algebra 2

8.3

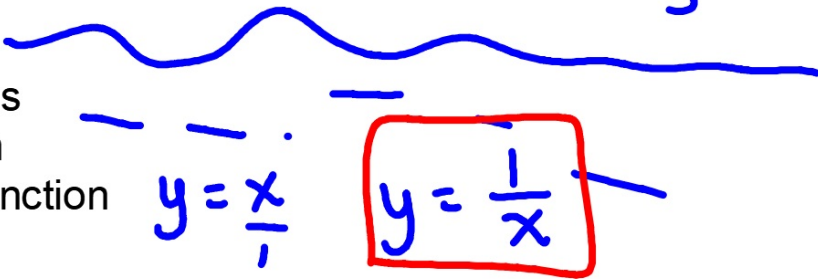
Quiz 8.1-8.2 Tues.

Determine properties of reciprocal functions

Graph transformations of reciprocal functions

$$\frac{2}{5} \quad \frac{5}{2}$$

continuous  
discontinuous  
parent graph  
reciprocal function  
hyperbola  
asymptote  
domain  
range



x's  
y's

Is it ever OK to divide by zero?

whiteboards

Graph  $y = 1/x$

$x$	$\frac{1}{x}$
1	1
2	$\frac{1}{2}$
$\frac{1}{3}$	3
$\frac{1}{10}$	10
5	$\frac{1}{5}$

D:

$x \neq 0$  ARN

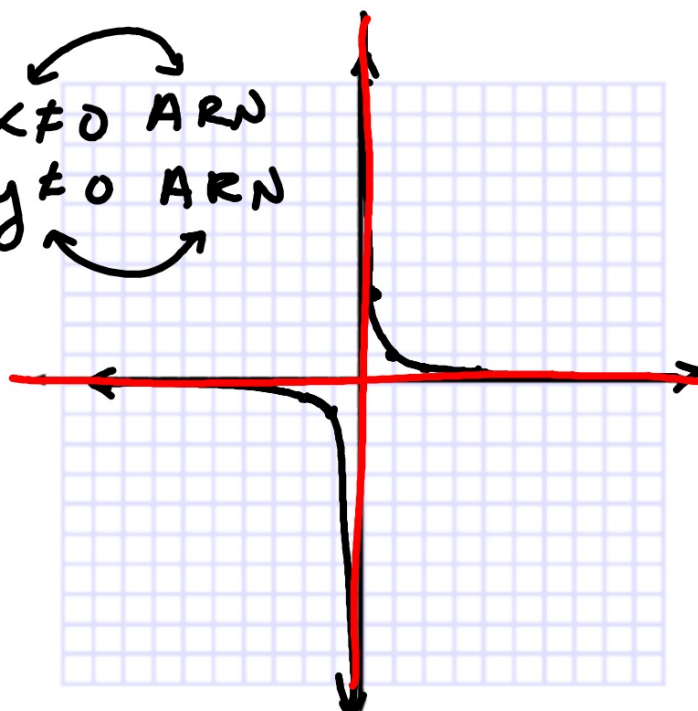
R:

$y \neq 0$  ARN

Are there any value(s) that can't be used?

$y = (x-3)^2 + 5$

-1	-1
-2	$-\frac{1}{2}$
-4	$-\frac{1}{4}$
$-\frac{1}{10}$	$-\frac{1}{10}$



### KeyConcept Parent Function of Reciprocal Functions

Parent function:  $f(x) = \frac{1}{x}$

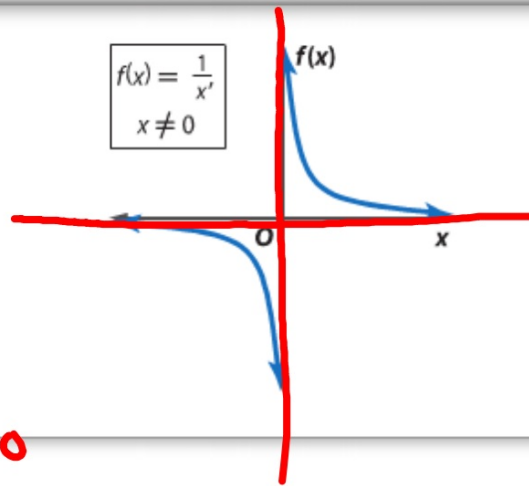
Type of graph: \* **hyperbola**

Domain and range: all nonzero real numbers

Asymptotes:  $x = 0$  and  $f(x) = 0$

Intercepts: none

Not defined:  $x = 0$



Parent graph: VA =  $x = 0$     HA =  $y = 0$

(can't divide by 0)

The domain of a reciprocal function is limited to values for which the function is defined.

**Functions:**

$$f(x) = \frac{-3}{x+2}$$

$$g(x) = \frac{4}{x-5}$$

$$h(x) = \frac{3}{x}$$

**Not defined at:**  $x = -2$

$x = 5$

$x = 0$

Translation (L-R) changes VA



### Guided Practice

Determine the value of  $x$  for which each function is not defined.

1A.  $f(x) = \frac{2}{(x-1)}$



$$x-1 = 0$$

$$x = 1$$

1B.  $f(x) = \frac{7}{(3x+2)}$



$$3x+2 = 0$$

$$\underline{-2 \quad -2}$$

$$\frac{3x}{3} = \frac{-2}{3}$$

What would make the denom = 0?  
Can't be used (domain)

### Example 1 Limitations on Domain

Determine the value of  $x$  for which  $f(x) = \frac{3}{2x + 5}$  is not defined.

VA = undefined; HA = end behavior  
Compare to parent graph...

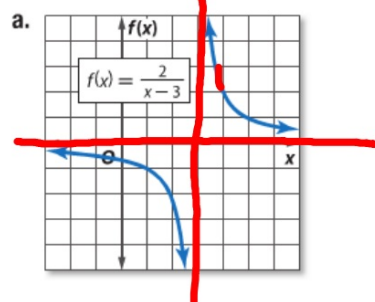
**StudyTip**

**CCSS Structure** Vertical asymptotes show where a function is undefined, while horizontal asymptotes show the end behavior of a graph.

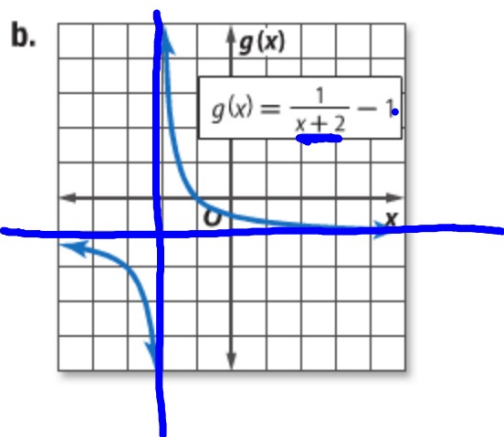
**Example 2** Determine Properties of Reciprocal Functions



Identify the asymptotes, domain, and range of each function.



VA  $x=3$   
HA  $y=0$   
D:  $\text{ARN } x \neq 3$   
R:  $\text{ARN } y \neq 0$



Compare to parent graph  
(Don't go by eyeball)

$$VA \quad x = -2$$

$$HA \quad y = -1$$

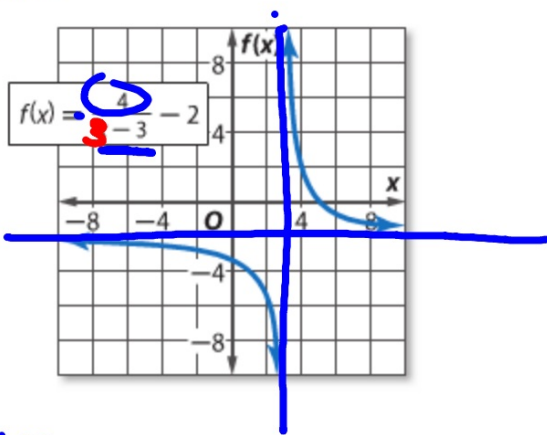
$$D \text{ ARN } x \neq -2$$

$$R \text{ ARN } y \neq -1$$



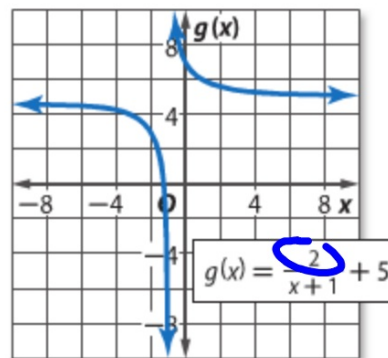
### Guided Practice

2A.



VA  $x = 3$   
HA  $y = -2 \dots \dots \dots$

2B.



VA  $x = -1$   
HA  $y = 5$

**StudyTip**

**Asymptotes** The asymptotes of a reciprocal function move with the graph of the function and intersect at  $(h, k)$ .

**KeyConcept** Transformations of Reciprocal Functions

$$f(x) = \frac{a}{x-h} + k$$

 **$h$  – Horizontal Translation**

$h$  units right if  $h$  is positive  
 $|h|$  units left if  $h$  is negative

The *vertical* asymptote is at  $x = h$ .

 **$k$  – Vertical Translation**

$k$  units up if  $k$  is positive  
 $|k|$  units down if  $k$  is negative

The *horizontal* asymptote is at  $f(x) = k$ .

 **$a$  – Orientation and Shape**

If  $a < 0$ , the graph is reflected across the  $x$ -axis.

If  $|a| > 1$ , the graph is stretched vertically.  
If  $0 < |a| < 1$ , the graph is compressed vertically.

### Example 3 Graph Transformations

Graph each function. State the domain and range.

a.  $f(x) = \frac{-2}{x-4} + 2$

D:  $\mathbb{R} \setminus \{4\}$

R:  $\mathbb{R} \setminus \{2\}$

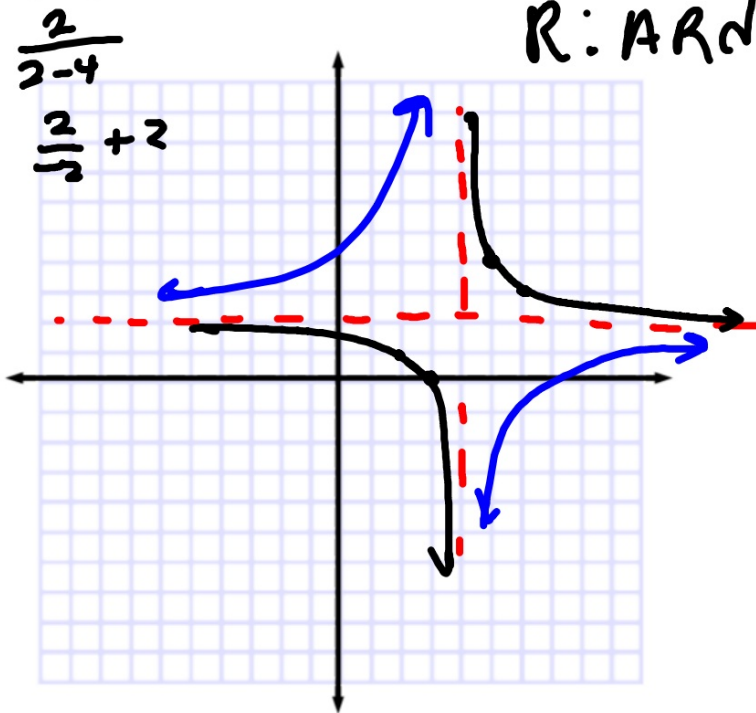
parent graph

VA

HA

reflection (maybe?)

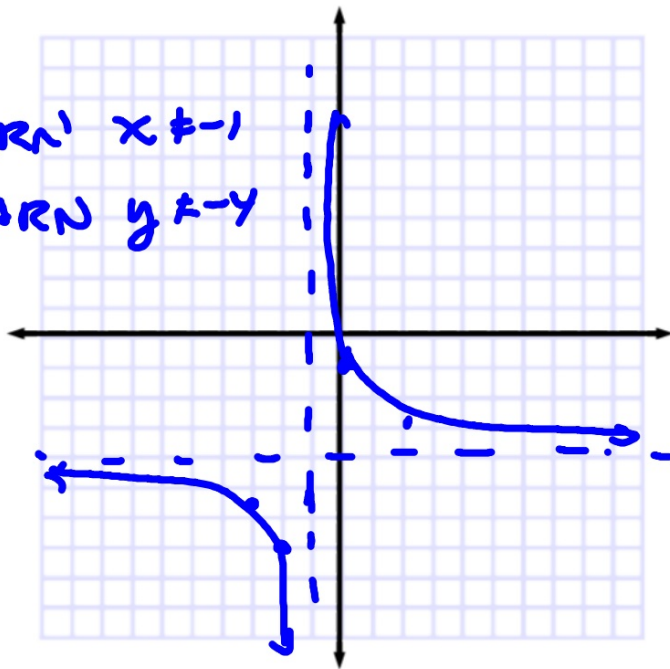
find a few ord prs to locate the "quadrants"



5	4
6	3
3	0
2	1

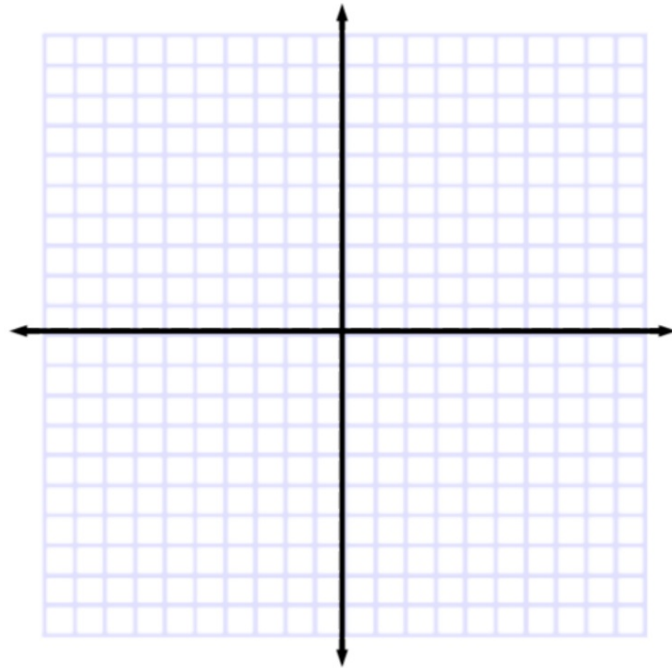
b.  $f(x) = \frac{3}{x+1} - 4$

D.ARN'  $x \neq -1$   
R.ARN'  $y \neq -4$



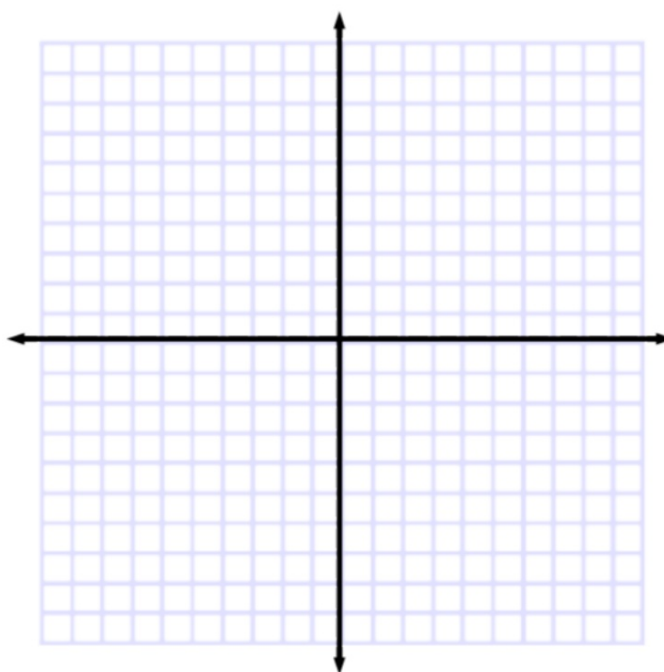
x		
0	$\frac{3}{1} - 4$	-1
2	$\frac{3}{3} - 4$	-3
-2	$\frac{3}{-1} - 4$	-7
-3	$\frac{3}{-2} - 4$	-5.5

b.  $f(x) = \frac{-3}{x+1} - 4$



**Guided Practice**

3A.  $f(x) = \frac{-2}{x+4} + 1$



3B.  $g(x) = \frac{1}{3(x-1)} - 2$

